

What is claimed is:

1. Apparatus for detecting arcs on an electrical power distribution network having at least one conductor comprising:

series inductance means adapted to be coupled in series with a conductor of the network wherein a voltage is produced across the series inductance means having a waveform which relates to the derivative of current flow in the conductor; and

arc detection means coupled to identify when the waveform of the voltage across the series inductance means is representative of arcing on the network and to generate an arc detection signal when the waveform is representative of arcing on the network.

2. The apparatus of claim 1 wherein the at least one conductor comprises a neutral conductor and a phase conductor.

3. The apparatus of claim 1 wherein the at least one conductor comprises a neutral conductor and two phase conductors.

4. The apparatus of claim 1 wherein the at least one conductor comprises a neutral conductor and three phase conductors.

5. The apparatus of claim 1 wherein the at least one conductor comprises two phase conductors.

6. The apparatus of claim 1 wherein the at least one conductor comprises a single conductor with return current carried through a ground or frame.

7. The apparatus of claim 1 wherein the series inductance means is adapted to be coupled to be in series with all current in the at least one conductor.

8. The apparatus of claim 1 wherein the series inductance means is adapted to be coupled in series with part of the current in the at least one conductor.

9. The apparatus of claim 1 wherein the series inductance means is an inductor.

10. The apparatus of claim 1 wherein the series inductance means is at least one winding of a transformer.

11. The apparatus of claim 10 wherein the transformer is coupled to a current
5 measuring means to measure current in at least one conductor of the network.

12. The apparatus of claim 10 wherein the transformer forms part of a ground fault means to measure ground fault differential current flow in at least two conductors of the network.

13. The apparatus of claim 10 wherein the transformer forms part of a ground fault means to measure ground fault grounded neutral current flow in at least one conductor of the
10 network.

14. The apparatus of claim 1 wherein the series inductance means has an inductance of between .1 and 1,000,000 nanohenries.

15. The apparatus of claim 1 wherein the series inductance means comprises a conductor having a bend between 15 degrees and a turn of 360 degrees.

16. The apparatus of claim 1 wherein the series inductance means comprises a
15 conductor having between one and six turns.

17. The apparatus of claim 1 further comprising clamping means coupled in parallel with the series inductance means.

18. The apparatus of claim 17 wherein the clamping means comprises at least one
20 diode.

19. The apparatus of claim 17 wherein the at least one diode comprises a first diode coupled in parallel with a second diode head-to-toe.

20. The apparatus of claim 17 wherein the clamping means comprises at least one Zener diode.

21. The apparatus of claim 17 wherein the at least one diode comprises first and second Zener diodes coupled in parallel head-to-toe.

5 22. The apparatus of claim 17 wherein the at least one diode comprises first and second Zener diodes coupled back-to-back.

23. The apparatus of claim 17 wherein the clamping means comprises an avalanche diode.

24. The apparatus of claim 17 wherein the clamping means comprises a diac.

10 25. The apparatus of claim 17 wherein the clamping means comprises an MOV.

26. The apparatus of claim 17 wherein the clamping means comprises a sidac.

27. The apparatus of claim 17 wherein the clamping means comprises a transorb.

28. The apparatus of claim 17 wherein the clamping means comprises a gas tube.

15 29. The apparatus of claim 9 wherein the inductor is oriented orthogonally to the electronics circuitry of the arc detection means.

30. The apparatus of claim 9 wherein the inductor is oriented orthogonally to the electronics circuitry of the device the apparatus is coupled to.

31. The apparatus of claim 10 wherein the at least one winding of the transformer is oriented orthogonally to the electronics circuitry of the arc detection means.

20 32. The apparatus of claim 1 further comprising:

trip means coupled to the arc detection signal from the arc detection means to interrupt current flow in at least one conductor of the electrical power distribution network.

33. The apparatus of claim 1 further comprising:

5 annunciating means coupled to the arc detection means to indicate the status of the arc detection signal.

34. The apparatus of claim 33 wherein the annunciator means is at least one LED.

35. The apparatus of claim 33 wherein the annunciator means is at least one lamp.

36. The apparatus of claim 33 wherein the annunciator means is at least one audio generating means.

10 37. The apparatus of claim 33 wherein the annunciation means is a graphical or alphanumeric display.

38. Apparatus for detecting arcs on an electrical power distribution network having at least two conductors comprising:

15 a first series inductance means adapted to be coupled to a first of the at least two conductors to produce a voltage across itself related to the derivative of current flow in the first conductor;

 a second series inductance means adapted to be coupled to a second of the at least two conductors to produce a voltage across itself related to the derivative of current flow in the second conductor; and

20 an arc detection means responsive to the waveforms of the voltages across all of the series inductance means to determine when a waveform indicative of arcing on the network is present and to generate an arc detection signal when arcing is present.

39. The apparatus of claim 38 further comprising:

a third series inductance means coupled in series with a third conductor of the network to produce a voltage across itself related to the derivative of current flow in the third conductor.

5 40. Apparatus for detecting arcs on an electrical power distribution network having at least two conductors comprising:

a first series inductance means adapted to be coupled to a first of the at least two conductors to produce a voltage across itself related to the derivative of current flow in the first conductor;

10 a second series inductance means adapted to be coupled to a second of the at least two conductors to generate magnetic flux related to the derivative of current flow in the second conductor;

flux coupling means to link the magnetic flux of the second series inductance to the first series inductance; and

15 arc detection means responsive to the waveform of the voltage across the first series inductance means to determine when a waveform indicative of arcing on the network is present and to generate an arc detection signal when a waveform indicative of arcing is present.

41. The apparatus of claim 40 further comprising:

20 a third series inductance means coupled to a third conductor of the network to generate magnetic flux related to the derivative of current flow in the third conductor and coupled to link the magnetic flux of the third series inductances to the first series inductance through the flux coupling means.

42. The apparatus of claim 40 or 41 wherein the flux coupling means is a magnetic core.

43. The apparatus of claim 40 or 41 wherein the flux coupling means is an air core.

25 44. The apparatus of claim 40 further comprising:

a ground fault current measuring means to measure the ground fault current in at least two of the conductors of the network; and

a ground fault current detection means responsive to the ground fault current measuring means to generate a ground fault detection signal when a ground fault is present.

5 45. The apparatus of claim 44 further comprising:

trip means responsive to the arc detection signal and the ground fault detection signal to interrupt current flow in at least one conductor of the electrical power distribution network.

 46. The apparatus of claim 44 further comprising:

10 annunciating means coupled to the arc detection means and the ground fault current detection means to indicate the status of the arc detection signal and/or ground fault detection signal.

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